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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/792,108
Filing Date: March 03, 2004
Appellant(s): KREISCHER, BRUCE E.

MAILED
DEC 2 6 2007
GROUP 1700

Grant Rodolph
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 26 November 2007 appealing from the Office action mailed 29 June 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. However, Examiner notes that claims 9-13 have not been rejected

over Dixon in view of Seader (see Office Action mailed 29 June 2007 at page 3, paragraph 7). Thus, the correct grounds for rejection to be reviewed on appeal should read, in part:

"Whether claims 1-8, 14-16, 20-26, and 28-34 are unpatentable over WO 03/053890 (*Dixon*) in view of Seader, et al., Perry's Chemical Engineers' Handbook, 7th Ed., New York, McGraw Hill, 1997, pp. 13-4 – 13-9 (*Seader*) under 35 U.S.C. § 103(a)."

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

WO 03/053890 A1	DIXON et al.	07-2003
WO 99/19280 A1	WOODARD et al.	04-1999
Distillation in PERRY'S CHEMICAL ENGINEER'S HANDBOOK, 7th ed., New York, McGraw Hill, 1997, pp. 13-4 – 13-9	SEADER et al.	1997

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

   1. Determining the scope and contents of the prior art.
   2. Ascertaining the differences between the prior art and the claims at issue.
   3. Resolving the level of ordinary skill in the pertinent art.
   4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-8, 14-16, 20-26, and 28-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dixon (WO 03/053890 A1) in view of Seader et al., *Perry's Chemical Engineers' Handbook*, 7th ed. New York, McGraw Hill, 1997, pp. 13-4 – 13-9.

4. With respect to claim 1, Dixon discloses a method for separating an oligomerization reactor effluent comprising: (a) separating the oligomerization reactor effluent (9) into a liquid portion (17) and a vapor portion (10); (b) feeding the liquid portion (17) of the oligomerization effluent (9) to a liquid feed inlet on a distillation column (4); (c) feeding the vapor portion (10) of the oligomerization reactor effluent (9) to a vapor feed inlet on a second distillation column (3); and (d) withdrawing an oligomerization product stream (11).

Dixon does not disclose wherein the liquid and vapor portions of the oligomeriza-

tion reactor effluent are fed to the same distillation column, and wherein the oligomerization product is withdrawn from a side drawn outlet located between the liquid feed and vapor feed inlets to the column.

However, Dixon discloses that his invention is not in any way limited to the process flow diagram of his Figure 2, which only shows a single embodiment of the process of his invention (see Dixon, page 14, lines 20-26). In addition, Seader discloses a thermally coupled separation system for the separation of a ternary stream in which a first separator is used to separate the majority of light components into the vapor phase and heavy components into the liquid phase (see Seader, page 13-5). The vapor and liquid product streams from the first separator are then directed to a second separator (i.e. distillation column) wherein all three products are produced, with the middle product (corresponding to the intermediate boiling species) being taken off as a sidestream whose outlet is located at a point between the vapor feed inlet and liquid feed inlet from the first separator (see Seader, page 13-5, and page 13-8, Figure 13-6b). Seader explains that such a separation scheme is particularly useful for reducing energy requirements when the initial feed contains close-boiling species (e.g. those present in the oligomerization reactor effluent stream of Dixon) (see Seader, page 13-5). Additionally, Seader discloses use of a single-stage flash (e.g. for use as a first separator in the separation scheme) where the relative volatility between two components to be separated is relatively large (e.g. the unreacted ethylene and 1-hexene product present in the oligomerization reactor effluent of Dixon), or where only a partial separation is to be made (e.g. for partial separation of the 1-hexene product in

the oligomerization reactor effluent of Dixon) (see Seader, page 13-6, and page 13-9, Figure 13-7a).

Therefore, the person having ordinary skill in the art of separating oligomerization reactor effluent streams would have been motivated to modify the process of Dixon to provide for (1) flashing the oligomerization reactor effluent in a single-stage flash of the type disclosed by Seader, and (2) feeding the liquid and vapor portions of the oligomerization reactor effluent to the same distillation column, and withdrawing the oligomerization product from a side drawn outlet located between the liquid feed and vapor feed inlets to the column (as suggested by the various distillation flow schemes of Seader) in order to achieve greater process efficiency and improved economics and to complete separation of the effluent stream into three individual process streams: (a) a lights stream comprised primarily of ethylene, (b) a product stream comprised primarily of 1-hexene and solvent, and (c) a heavies stream comprised primarily of solvent and other residual components.

Finally, the person having ordinary skill in the art of separating oligomerization reactor effluent streams would have had a reasonable expectation of success in modifying the process of Dixon as described above because (1) Dixon explains that the process of his invention is not in any way limited to the single embodiment shown in his Figure 2 (i.e. Dixon contemplates a modification of his process as shown); (2) Seader discloses the use of a single-stage flash where only a partial (i.e. preliminary) separation is to be made (e.g. partial separation of the 1-hexene product present in the oligomerization reactor effluent of Dixon); and (3) Seader discloses the use of a single

column coupled to a prefractionator (which allows for a split of the intermediate component to be separated, e.g. the 1-hexene product present in the oligomerization reactor effluent of Dixon) for separation of a ternary feed.

5. With respect to claim 2, Dixon discloses wherein the oligomerization reactor effluent is from a trimerization reactor (see Dixon, page 3, lines 12-15).

6. With respect to claim 3, Dixon discloses wherein the oligomerization reactor effluent is from trimerization of ethylene to 1-hexene (see Dixon, Example 6).

7. With respect to claims 4-7, Dixon discloses wherein the solvent comprises cyclohexane (see Dixon, Example 6 and Table 2).

8. With respect to claim 8, Dixon discloses wherein the oligomerization reactor effluent comprises a catalyst system (see Dixon, page 15, lines 3-6).

9. With respect to claim 14, Dixon discloses wherein the oligomerization product stream comprises 1-hexene and solvent (see Dixon, page 15, lines 20-22).

10. With respect to claim 15, Seader discloses the flashing of a multi-component stream (see Seader, page 13-6, and page 13-9, Figure 13-7a).

11. With respect to claim 16, Seader discloses wherein distilling is performed in a common distillation column (see Seader, page 13-8, Figure 13-6b).

12. With respect to claim 20, Seader discloses wherein the distillation column comprises a number of stages between the liquid feed inlet and side draw outlet effective to separate heavies (i.e. bottoms product) from the intermediate product (see Seader, page 13-8, Figure 13-6b).

13. With respect to claim 21, Seader discloses wherein the distillation column comprises a number of stages between the vapor feed inlet and the side draw outlet effective to separate lights (i.e. overhead product) from the intermediate product (see Seader, page 13-8, Figure 13-6b).

14. With respect to claim 22, Dixon discloses separating 1-hexene and cyclohexane from the oligomerization product stream (see Dixon, page 15, lines 20-22).

15. With respect to claim 23, Dixon discloses wherein the oligomerization reactor effluent having a composition greater than 90% by weight of C_6 components (see Dixon, Table 2).

16. With respect to claim 24, Seader discloses wherein the liquid portion is expected to comprise a portion of the component(s) of intermediate volatility as well as other heavy components (see Seader, page 13-5).

17. With respect to claim 25, Seader discloses wherein the vapor portion is expected to comprise a portion of the component(s) of intermediate volatility as well as other light components (see Seader, page 13-5).

18. With respect to claim 26, Seader discloses wherein the component(s) of intermediate volatility are concentrated in the intermediate product stream (see Seader, page 13-5, and page 13-8, Figure 13-6b).

19. With respect to claim 28, Seader discloses a system for separating an effluent comprising (a) a vapor/liquid separator to flash the effluent into a vapor portion and liquid portion (see Seader, page 13-9, Figure 13-7a); and (b) a distillation column in fluid communication with the vapor/liquid separator, wherein the distillation column has a

side draw for withdrawing a product stream and receives as separate feeds the vapor portion and the liquid portion from the vapor/liquid separator (see Seader, page 13-8, Figure 13-6b).

20. With respect to claim 29, Seader discloses wherein the liquid portion is fed to the distillation column at a location below the side draw (see Seader, page 13-8, Figure 13-6b).

21. With respect to claim 30, Seader discloses wherein the vapor portion is fed to the distillation column at a location above the side draw (see Seader, page 13-8, Figure 13-6b).

22. With respect to claims 31 and 32, Dixon discloses a trimerization reactor for providing oligomerization reactor effluent, wherein the trimerization reactor is in fluid communication with the vapor/liquid separator, and wherein the second distillation column separates trimerization product from solvent (see Dixon, Figure 2).

23. With respect to claim 33, it is known in the art to use additional distillation columns to further resolve a binary stream.

24. With respect to claim 34, Seader discloses wherein the distillation column has at least 3 off-takes and at least 2 inputs (see Seader, page 13-8, Figure 13-6b).

25. Claims 1-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Woodard (WO 99/19280) in view of Seader et al., *Perry's Chemical Engineers' Handbook*, 7th ed. New York, McGraw Hill, 1997, pp. 13-4 – 13-9.

26. With respect to claim 1, Woodard discloses a method for separating an oligomerization reactor effluent comprising: (a) separating the oligomerization reactor

effluent (6, 8) into a liquid portion (12) and a vapor portion (11); (b) feeding the liquid portion (12) of the oligomerization effluent (6, 8) to a liquid feed inlet on a distillation column (41); (c) feeding the vapor portion (11) of the oligomerization reactor effluent (6, 8) to a vapor feed inlet on a second distillation column (13); and (d) withdrawing an oligomerization product stream.

Woodard does not disclose wherein the liquid and vapor portions of the oligomerization reactor effluent are fed to the same distillation column, and wherein the oligomerization product is withdrawn from a side drawn outlet located between the liquid feed and vapor feed inlets to the column.

However, Woodard discloses that his invention is not in any way limited to the process flow diagram of the Figures 1 through 6 that show different embodiments of the process of his invention. In addition, Seader discloses a thermally coupled separation system for the separation of a ternary stream in which a first separator is used to separate the majority of light components into the vapor phase and heavy components into the liquid phase (see Seader, page 13-5). The vapor and liquid product streams from the first separator are then directed to a second separator (i.e. distillation column) wherein all three products are produced, with the middle product (corresponding to the intermediate boiling species) being taken off as a sidestream whose outlet is located at a point between the vapor feed inlet and liquid feed inlet from the first separator (see Seader, page 13-5, and page 13-8, Figure 13-6b). Seader explains that such a separation scheme is particularly useful for reducing energy requirements when the initial feed contains close-boiling species (e.g. those present in the oligomerization

reactor effluent stream of Woodard) (see Seader, page 13-5). Additionally, Seader discloses use of a single-stage flash (e.g. for use as a first separator in the separation scheme) where the relative volatility between two components to be separated is relatively large (e.g. the unreacted ethylene and 1-hexene product present in the oligomerization reactor effluent of Woodard), or where only a partial separation is to be made (e.g. partial separation of the 1-hexene product present in the oligomerization reactor effluent of Woodard) (see Seader, page 13-6, and page 13-9, Figure 13-7a).

Therefore, the person having ordinary skill in the art of separating oligomerization reactor effluent streams would have been motivated to modify the process of Woodard to provide for (1) flashing the oligomerization reactor effluent in a single-stage flash of the type disclosed by Seader, and (2) feeding the liquid and vapor portions of the oligomerization reactor effluent to the same distillation column, and withdrawing the oligomerization product from a side drawn outlet located between the liquid feed and vapor feed inlets to the column (as suggested by the various distillation flow schemes of Seader) in order to achieve greater process efficiency and improved economics and to complete separation of the effluent stream into three individual process streams: (a) a lights stream comprised primarily of ethylene, (b) a product stream comprised primarily of 1-hexene and solvent, and (c) a heavies stream comprised primarily of solvent and other residual components.

Finally, the person having ordinary skill in the art of separating oligomerization reactor effluent streams would have had a reasonable expectation of success in modifying the process of Woodard as described above because (1) Woodard explains

that the process of his invention is not in any way limited to the different embodiments shown in his Figures 1 through 6 (i.e. Woodard contemplates a modification of his process as shown); (2) Seader discloses the use of a single-stage flash where only a partial (i.e. preliminary) separation is to be made (e.g. partial separation of the 1-hexene product present in the oligomerization reactor effluent of Woodard); and (3) Seader discloses the use of a single column coupled to a prefractionator (which allows for a split of the intermediate component to be separated, e.g. the 1-hexene product present in the oligomerization reactor effluent of Woodard) for separation of a ternary feed.

27. With respect to claims 2 and 3, Woodard discloses wherein the oligomerization reactor effluent is from trimerization of ethylene to 1-hexene (see Woodard, page 1, lines 20-26).

28. With respect to claims 4-7, Woodard discloses wherein the solvent comprises cyclohexane (see Woodard, page 9, lines 14-19).

29. With respect to claim 8, Woodard discloses wherein the oligomerization reactor effluent comprises a catalyst system (see Woodard, page 2, lines 23-28).

30. With respect to claim 9, Woodard discloses a catalyst system composed of a chromium source (see Woodard, page 2, lines 23-24), a pyrrole-containing compound (see Woodard, page 2, lines 23-24), a methyl alkyl (see Woodard, page 5, lines 5-7), and a halide source (see Woodard, page 6, line 27).

31. With respect to claim 10, Woodard discloses a method of separating an oligomerization reactor effluent, further comprising killing the catalyst system prior to distilling the portions of the oligomerization reactor effluent (see Woodard, Figure 1).

32. With respect to claims 11-13, Woodard discloses wherein the catalyst system is killed with an alcohol (see Woodard, page 15, lines 28-30).

(10) Response to Argument

Before addressing appellant's arguments, Examiner notes as a preliminary matter and for further clarification of the record that it is Examiner's position that Applicant's claims are unpatentable over Dixon or Woodard in view of Seader because all of Applicant's claim limitations can be met by simply modifying the processes or Dixon or Woodard in light of Seader's teachings. In this regard, Examiner finds that the processes of Dixon or Woodard can be modified to ***either*** ***(1)*** perform the claimed separation by using the setup of Seader's Fig. 13-6(b) as it is shown in that figure with the first column (which Seader refers to as a "prefractionator") serving as a means for "flashing the oligomerization reactor effluent into a liquid portion and a vapor portion" (first combinatory use of Seader); ***or*** ***(2)*** perform the claimed separation by replacing the first column (i.e. "prefractionator") of Seader's Fig. 13-6(b) with the flash drum of Seader's Fig. 13-7(a) and whereby the flash drum would deliver separate vapor and liquid input streams to the second column of Seader's Fig. 13-6(b) (second combinatory use of Seader) (see Office Action mailed 29 June 2007, pages 12-13 at paragraph 40).

In view of Examiner's aforementioned *alternative* combinatory uses of Seader's teachings, Examiner notes that the entirety of appellant's brief has only addressed the claim rejections based on Examiner's *second* combinatory use of Seader, i.e. wherein the flash drum of Seader's Fig. 13-7(a) would replace the first column (i.e.

"prefractionator") of Seader's Fig. 13-6(b), the flash drum thereby serving as a means for "flashing the oligomerization reactor effluent into a liquid portion and a vapor portion" (Applicant's claim 1) and "a vapor/liquid separator to flash the oligomerization reactor effluent into a vapor portion and a liquid portion" (Applicant's claim 28).

Thus, appellant has *not* addressed Examiner's rejections based on Examiner's *first* combinatory use of Seader, i.e. with the "prefractionator" of Seader's Fig. 13-6(b) serving as a means for "flashing the oligomerization reactor effluent into a liquid portion and a vapor portion" (Applicant's claim 1) and "a vapor/liquid separator to flash the oligomerization reactor effluent into a vapor portion and a liquid portion" (Applicant's claim 28) *without substitution* of the flash drum of Seader's Fig. 13-7(a) for the prefractionator of Seader's Fig. 13-6(b).

Appellant's arguments on pages 9-10

Appellant argues on page 10 that only by creating the "Examiner-Modified Petlyuk System" (see drawing at page 9 of Appellant's brief) and combining it with Dixon or Woodard is the Examiner able to achieve the separation system recited in the claims.

Examiner finds Appellant's argument to be unpersuasive because Appellant only refers to Examiner's *second* combinatory use of Seader.

In this regard, Examiner submits that the *first* combinatory use of Seader (i.e. wherein the claimed separation is performed in the *unmodified* system of Seader's Fig. 13-6(b)) together with the teachings of either Dixon or Woodard achieves the separation system of Applicant's claims 1 and 28, with the first column (i.e. "prefractionator") of

Seader's Fig 13-6(b) serving as the means for "flashing the oligomerization reactor effluent into a liquid portion and a vapor portion" (claim 1) and "a vapor/liquid separator to flash the oligomerization reactor effluent into a vapor portion and a liquid portion" (claim 28).

Appellant's arguments on pages 10-11

Appellant argues on pages 10-11 that the "Examiner-Modified Petlyuk System" (see drawing at page 9 of Appellant's brief) is a prohibited modification of Seader because it changes the principle of operation of the Petyluk towers. Appellant argues that because the Petyluk towers operate via the principle of thermal coupling, the elimination of this coupling would change the principle of operation of the Petlyuk towers.

First, Examiner submits that elimination of the prefractionator of Seader's Fig. 13-6(b) would not destroy operability of the Petlyuk distillation towers configuration. Examiner notes that while Seader (in Fig. 13-6(b)) discloses reflux of liquid and vapor from the main column back to the prefractionator (i.e. first column), he does not specify any minimum reflux ratio. Thus, Examiner finds that replacement of the prefractionator of Seader's Fig. 13-6(b) with the flash drum of Seader's Fig. 13-7(a) (and having no reflux back to the flash drum) would not operate any differently than the setup as shown in Fig. 13-6(b) having a very small reflux ratio (i.e. the ratio of the amount of condensate or vapor being returned to the amount being withdrawn).

Second, Examiner notes that the court has emphasized that the proper inquiry is "'whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination,' not whether there is something in the prior art as a whole to suggest that the combination is the *most desirable* combination available" (emphasis added). *See* MPEP § 2143.01(I) (citing *In re Fulton*, 391 F.3d 1195, 73 USPQ2d 1141 (Fed. Cir. 2004)). Thus, while having a flash drum with no means for reflux serve as the prefractionator of Seader's Fig. 13-6(b) may not be the "most desirable" combination in the context of a Petlyuk separation system, Examiner submits that the operability of such a system would not be "destroyed," and indeed would be no worse than a thermally coupled system (i.e. having a prefractionator with reflux thereto) with a very small reflux ratio.

Finally, Examiner again notes that Appellant has not addressed Examiner's rejection of the claims based on Examiner's *first* combinatory use of Seader. In this regard, Appellant's arguments are moot because thermal coupling of the prefractionator to the main column in Seader's Fig. 13-6(b) would be preserved.

Appellant's arguments on pages 12-13

Appellant argues on pages 12-13 that the "Examiner-Modified Petlyuk System" (see drawing at page 9 of Appellant's brief) is a prohibited modification of Seader because Seader teaches away from the substitution of the flash drum for the prefractionator in the Petlyuk towers.

Examiner finds Appellant's arguments to be unpersuasive because Seader does not "teach away" from the substitution of the flash drum for the prefractionator in the Petlyuk towers.

First, Examiner submits that prior art references "teach away" only when the proposed combination of references would render the base reference inoperable for its intended purpose. *See generally*, McGinley v. Frankling Sports, Inc., 262 F.3d 1339 (Fed. Cir. 2001). In this regard, Examiner notes that Seader discloses the use of a single-stage flash drum as shown in Fig. 13-7(a) for situations where only a partial separation is to be made (e.g. for performing a partial separation of the 1-hexene product of either Dixon or Woodard) (see Seader, page 13-6, first full paragraph). Moreover, Examiner understands the function of Seader's first column, or "prefractionator," of Fig. 13-6(b) to be exactly what its name implies – namely, to "prefractionate" or "partially separate" the components of the feed stream. Thus, in the context of Applicant's claims and in view of Seader's teachings along with those of Dixon and Woodard, Examiner finds the prefractionator of Seader's Fig. 13-6(b) and single-stage flash drum of Seader's Fig. 13-7(a) to be completely interchangeable for performing the claimed separation of oligomerization reactor effluent, because the function of both the prefractionator and the single-stage flash drum are exactly the same – to provide a partial separation of the feed.

Second, Examiner notes that Appellant's statement that "the Petlyuk towers' prefractionator is used for substantially complete separation of two components,

whereas the flash drum is used for partial separation of two components" (see Appellant's brief at page 13) is factually incorrect. As Seader clearly explains:

> *Petlyuk towers [are] particularly useful for reducing energy requirements when the initial feed contains close-boiling species. Shown for a ternary feed, the first column in Fig. 13-6b is a prefractionator, which sends essentially all of the light component and the heavy component to the distillate and bottoms respectively, but permits the component of intermediate volatility to be split between the distillate and the bottoms* (see Appellant's brief at page 12 (quoting Seader, pp. 13-5)).

Thus, it is clear from the above-cited passage from Seader that while the prefractionator may effect a complete separation of the *light component* and *heavy component*, the *component of intermediate volatility* is only *partially* separated. Likewise, Appellant's Table 1 at page 13 of the brief only notes differences in prefractionator and flash drum operations with respect to separation of the heavy and light components of a multi-component stream. However, the table does not specify any differences with respect to partial separation of a *component of intermediate volatility*, such as the desired 1-hexene product of both Dixon and Woodard. Moreover, Examiner notes that the flash drum may be used for separation of a *multi-component* (i.e. more than two components) stream (see Appellant's brief at page 12, quoting Seader "[a] single-stage flash, as shown in Fig. 13-7a, may be appropriate if . . . (2) the recovery of only one component, without regard to the separation of the other component**s**, in one of the two product streams is to be achieved.").

Finally, Examiner again notes that Appellant has not addressed Examiner's rejection of the claims based on Examiner's *first* combinatory use of Seader. In this

regard, Appellant's arguments are moot because there would be no substitution of the flash drum for the prefractionator in the Petyluk towers of Seader's Fig. 13-6(b).

(10) Response to Argument

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Randy P. Boyer Randy P. Boyer

Conferees:

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